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Substitute Specification

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Muffler

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Description

The invention relates to a muffler which is intended in particular also for internal combustion engines, having a housing through which a gaseous medium flows and which has at least one housing chamber and in which deflecting elements serving to make the gaseous medium swirl are arranged one behind another along an axis of the housing and in a positionally fixed manner at a distance from one another.

Mufflers of this type are disclosed, for example, in DE 848 877 and in DE 197 56 468 Cl. In the first-mentioned case, locking plates serving as deflecting

elements are provided and are inserted into the housing in such a manner that they form labyrinth-like flow paths for the gases without making metallic contact with the housing wall. Furthermore, a muffling material is provided and lines the inner wall of the housing in the form of a lining pad.

10 In the case of DE 197 56 468, disks which are similar to fan wheels are arranged in a positionally fixed manner in the housing in order to cause swirling of the gaseous medium. Disk-like insulating segments composed of sound-absorbing material are fitted in each case
15 between two successive disks and have free passage openings.

Furthermore, mufflers are known in which the flow of exhaust gas - in the case of internal combustion engines - is broken up by means of a complex arrangement of pipes and/or perforated intermediate walls and/or damping wool and, if appropriate, by means of additional rear mufflers and the noise produced by the emerging exhaust gas is thereby reduced. It is not
25 possible for these damping systems to be completely satisfactory in respect of the damping action and/or

the complexity and/or the adaptability to the particular application.

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Accordingly, the invention is based on the object of providing a muffler which is of particularly simple construction and, firstly, consists of simply designed elements and, secondly, is particularly effective and 10 flexible, with the result that it can also easily be adapted to different operating conditions.

To achieve this object, the invention makes provision, by means of the features of the defining part of patent 15 claim 1, for a disk-shaped body having slots to be provided in each case as deflecting element and to extend over the cross section of the housing chamber, and for guiding elements which bound the slots, are in the manner of guide vanes and belong to adjacent, disk-shaped bodies to deflect the flow in different 20 directions with respect to the main axis of the housing.

A muffler of this type manages without the use of 25 sound-absorbing material. Neither lining pads on the

inner walls of the housing nor insulating elements consisting of sound-absorbing material between the
5 deflecting elements are required. Just deflecting the flow with the aid of the guiding elements in the manner of guide vanes causes sound to be absorbed, in which case sound vibrations cancel one another out. This is achieved especially by different setting angles, in
10 particular if the guiding elements of adjacent, disk-shaped bodies are in each case preferably angled in an opposite direction to one another.

According to the invention, deviations and deflections
15 and also swirling of the gas flow therefore take place in the present case in such a manner that good muffling is produced.

At the same time, the muffler is of simple and compact
20 construction especially when disk-shaped bodies in the form of circular rings in an axial arrangement one behind another are used.

Furthermore, the muffling effect can be adapted without
25 any problem to the particular requirements, for which

purpose the number of slotted deflecting elements and/or the number of guiding elements in the form of
5 guide vanes per deflecting element and/or the shape and design of the guiding elements and/or the setting angles of the guiding elements and/or the orientation of the setting angle between adjacent deflecting elements can be changed. This permits specific
10 adaptation to each application or to different engines in a simple manner.

The invention will be explained in greater detail below with reference to exemplary embodiments which are
15 illustrated in the drawing, in which, in each case schematically:

fig. 1 shows a muffler in section;
fig. 2 shows a different view of the muffler according
20 to fig. 1 with the housing partially broken away and in a simplified illustration;
fig. 3 shows a perspective illustration on an enlarged scale of a modified muffler with the housing indicated by dashed lines and with five disk-shaped deflecting elements which are
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illustrated pulled apart in an exploded manner
and have guiding elements;

5 fig. 4 shows an illustration corresponding to fig. 3,
again on an enlarged scale, with deflecting
elements in the operating position with five
stages or deflecting elements and with some of
them at a different axial distance from one
10 another, and

fig. 5 shows, partially cut away, a muffler which has
been slightly modified in comparison to fig. 1
and has an alternative throughflow direction.

15 A muffler 1 comprises a housing 2 having at least one
housing part or a housing chamber. The housing 2 is
formed by a pot-shaped head element 3, which serves as
the housing chamber and has a front end wall 4, and by
a cup-shaped housing part 5, which likewise serves as
20 the housing chamber. The housing 2 furthermore has a
cylindrical circumferential wall 6 and an end wall 7 at
its one end.

According to the exemplary embodiments illustrated in
25 figs 1 and 2, a fastening edge 8 having a slightly

larger diameter and having fastening holes 9 distributed in the circumferential direction is 5 situated on the head element 3. The housing part 5 is pushed with its open end under the fastening edge 8 of the head element 3 until it makes contact. In the fitted position, the head element 3 and the housing part 5 are connected fixedly to each other. For this 10 purpose, fastening means 10 which extend through the fastening holes 9 are provided. Screw bolts or else rivets are suitable as fastening means 10.

According to the exemplary embodiment, a supporting 15 pipe 11 having a circular cross section extends along an axis of the housing through the end wall 4 at the head end and through the head element 3. The supporting pipe 11 protrudes with its one end outward through the end wall 4 where it forms an inlet stub, while its 20 other, likewise open end ends inside the housing 2 at a distance from the end wall 7 (fig. 1).

In the operating state, the gaseous medium/exhaust gas flows through the supporting pipe 11 into the housing 2 25 and emerges from the housing 2 through an outlet

stub/outflow stub 12. This outflow stub 12 can be fastened to the head element 3 in a radial arrangement 5 and can be open outward and toward the interior of the housing 2.

According to the exemplary embodiments illustrated in figs 1 and 2, and 5, four deflecting elements 13, 14, 10 15 and 16 in the manner of impellers are provided as sound-absorbing or swirling elements. According to the exemplary embodiment, said deflecting elements can be pushed in each case by means of a bushing-shaped or annular hub part 17 onto the supporting pipe 11. They 15 are arranged in a rotationally fixed or positionally fixed manner on the supporting pipe 11, it being possible for this to be achieved by a positive or non-positive connection between the hub parts 17 and the supporting pipe 11 or else by a separate locking means.

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Each deflecting element 13 to 16 in the manner of an impeller forms a muffler stage and has a plurality of guiding elements 18 in the manner of impellers or guide vanes. According to the exemplary embodiments 25 illustrated in figs 1 to 5, the deflecting elements 13

to 16' are in each case disk-shaped and slotted bodies 17' with in each case approximately 20 guiding elements 5 18 in the manner of guide vanes. The deflecting elements 13 and the disk-shaped slotted bodies 17' are expediently integral in each case with their guiding elements in the manner of guide vanes. They extend in the housing 2 as far as the cylindrical circumferential 10 wall 6.

The guiding elements 18 of each deflecting element 13 to 16 are inclined or angled at a uniform setting angle α of, for example, 15° (preferably between $^\circ$ and $^\circ$) 15 with respect to the respectively associated radial planes 19. The setting angles α of respectively adjacent deflecting elements are expediently set positively or negatively, as emerges from fig. 2. A flow which is originally essentially directed axially 20 is therefore correspondingly deflected in each case.

In the starting state, the disk-shaped bodies 17' are flat sheet-metal rings and, as disk blank, obtain narrow slots 18' which extend radially and 25 rectilinearly from the outside to the inside. Owing to

the slots 18' and owing to the circular-ring shape of the disk-shaped bodies 17', the guiding elements 18 are
5 in each case in the form of a sector of a circular ring. The positive and/or negative setting angles of the guiding elements mean that there are slot-shaped passage openings in each deflecting element with the effect of enabling the gaseous medium to flow through
10 the deflecting elements 13 to 16 in the longitudinal direction of the housing 2 irrespective of the respective deviations.

The illustrations in the figures show that the housing
15 2 of the muffler 1 does not have to be completely occupied with deflecting elements having guiding elements 18 corresponding to the elements 13 to 16. Although the deflecting elements 13 to 16, 16' are arranged one behind another along the main axis 19' of
20 the housing and in a positionally fixed manner at a distance from one another in order to make the flow medium swirl, the housing 2 nevertheless preferably has a completely unoccupied housing chamber part 2'. The housing chamber part 2' serves as a calming section.

In figs 1 and 2, a comparatively short supporting pipe
11 (for four deflecting elements 13 to 16) is provided
5 in conjunction with a comparatively long housing part 5
which could accommodate double or even triple the
number of deflecting elements. It may therefore be
expedient, in order to utilize the possibilities
arising from the compact construction in conjunction
10 with the variation in the number of deflecting
elements, to provide for the head element 3 different
housing parts 2 and supporting pipes 11 having a
graduated length which are then assembled as a function
of the particular application.

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Likewise, deflecting elements having guiding elements
which differ in terms of their number, their shape and
their setting angle, may also be provided for selection
to adapt them to the application conditions.

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Whereas the direction of flow of the gaseous medium in
the case of the muffler 1, which is illustrated in fig.
1 as an exemplary embodiment, is directed from the
outer opening of the supporting pipe 11 into the
25 interior of the cup-shaped housing part 5 and the gas

then flows through the deflecting elements of the various stages to the outflow stub 12, in the case of
5 the exemplary embodiment illustrated in fig. 5, an inlet stub 20 is situated at the one end 21 of the cup-shaped housing part 5 while an outlet stub 22 is arranged coaxially at the other end 23 of the cup-shaped housing part 5 - or, conversely, on its pot-shaped head element 3. An outflow stub 12 branching off
10 at right angles as in the case of the exemplary embodiment illustrated in fig. 1 is therefore not absolutely necessary.

15 Also, the function of the supporting pipe 11, which serves at the same time as an inlet stub, in the exemplary embodiment according to fig. 1 is omitted in the case of the muffler according to fig. 5, since there a centrally arranged support or a supporting
20 element 24 serves exclusively for supporting and/or connecting the muffler stages 25 comprising deflecting elements 13 to 16.

According to the exemplary embodiments illustrated in
25 figs 1 and 5, four or five muffler stages 25 are

provided in each case. However, more or fewer muffler stages 25 may also be arranged along the central 5 supporting element 24 in accordance with the particular conditions.

In addition, it is highly essential for the muffler according to the invention also to have only a very low 10 flow resistance in comparison to conventional mufflers.

In principle, the deflecting elements may consist of metal and may have solid or permeable guiding elements, for example in the form of a fine-meshed ribbed mesh. 15 Furthermore, plastics or composite materials are also suitable materials.

Finally, the deflecting elements 13 to 16' also prevent a back-surge in the muffler 1, which has a thermally 20 favorable effect in the case of an internal combustion engine.

Also, the variable arrangement and the variable number of deflecting elements in conjunction with variable 25 setting angles in a wide range of positive and negative

sizes of angle also enable certain frequencies to be filtered out or intended vibrations to be produced. In 5 terms of the valuable damping properties, the muffler is of comparatively simple and compact construction.

Furthermore, it is characteristic for those ends of the guiding elements 18 which are arranged at a distance 10 from the main axis 19' of the housing to be angled more sharply than their ends which are situated near the main axis 19' of the housing and for the guiding elements 18 to be able to be at least partially twisted in themselves.

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The invention is not restricted to the exemplary embodiments specifically illustrated in the figures; on the contrary, numerous modifications are possible without deviating from the basic concept of the 20 invention.

The same also applies in principle to the manner in which the muffler is used with it not being restricted to certain internal combustion engines, but rather 25 being able to be used very generally, this also

applying in particular to its use for model aircraft
and for engines having high speeds of rotation.

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As emerges from the figures, the deflecting elements of
the exemplary embodiments, which are in the manner of
impellers, are preferably caused by production to have
opposed, short slots 18'' directed in the
10 circumferential direction in the base region of the
guiding elements 18, which are in the manner of guide
vanes. As a result, each guiding element 18 is
connected to the hub part 17 by just a narrow web which
cannot be seen in the figures. The effect achieved by
15 this is that, if the need arises, each guiding element
18 in the manner of an impeller can be given a
completely flat, sheet-like shape in spite of the
setting angle α .

20 For strength reasons, after being slit in the
circumferential region, the guiding elements 18 can
additionally be soldered in the base region in a point-
like manner to the hub part 17 and to the supporting
pipe 11/to the supporting element 24.